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Falconieri et al.

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[54] **AUTOMATIC SHEET FEEDER**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **400/625;** 400/629; 400/631; 400/570; 400/551; 271/9

[58] **Field of Search** 400/551, 570, 624, 625, 400/628, 629, 631, 630; 271/9

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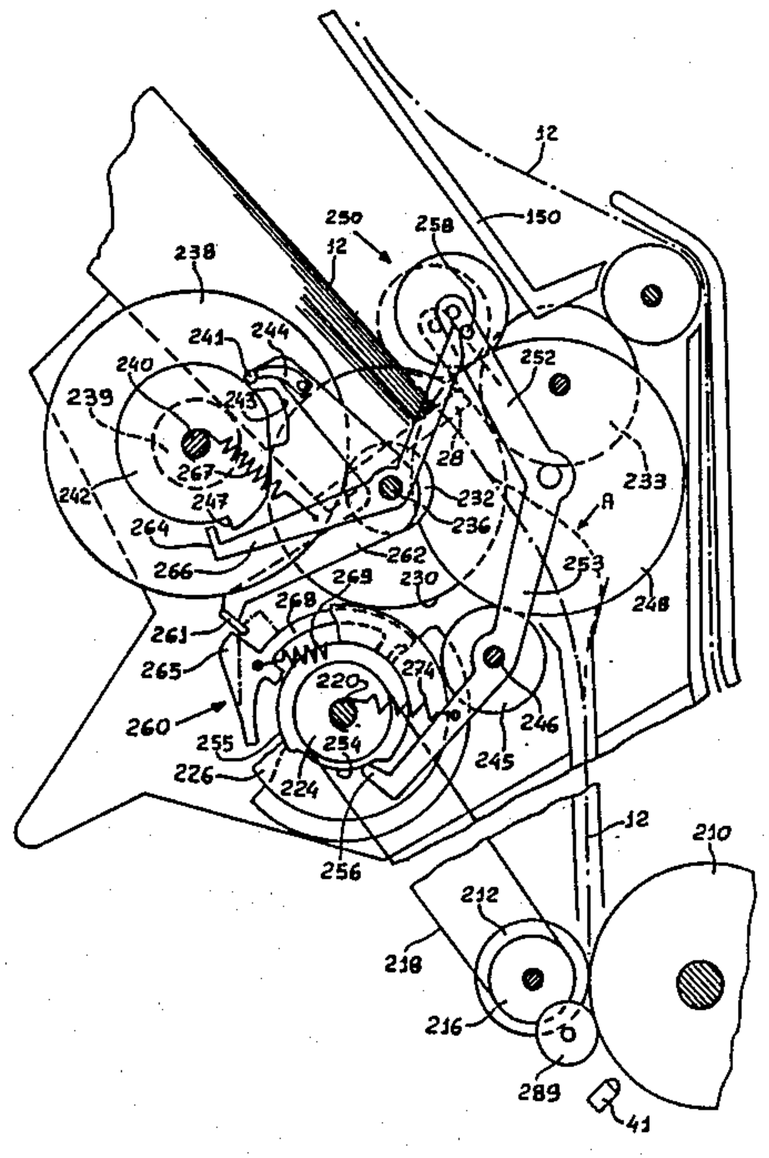
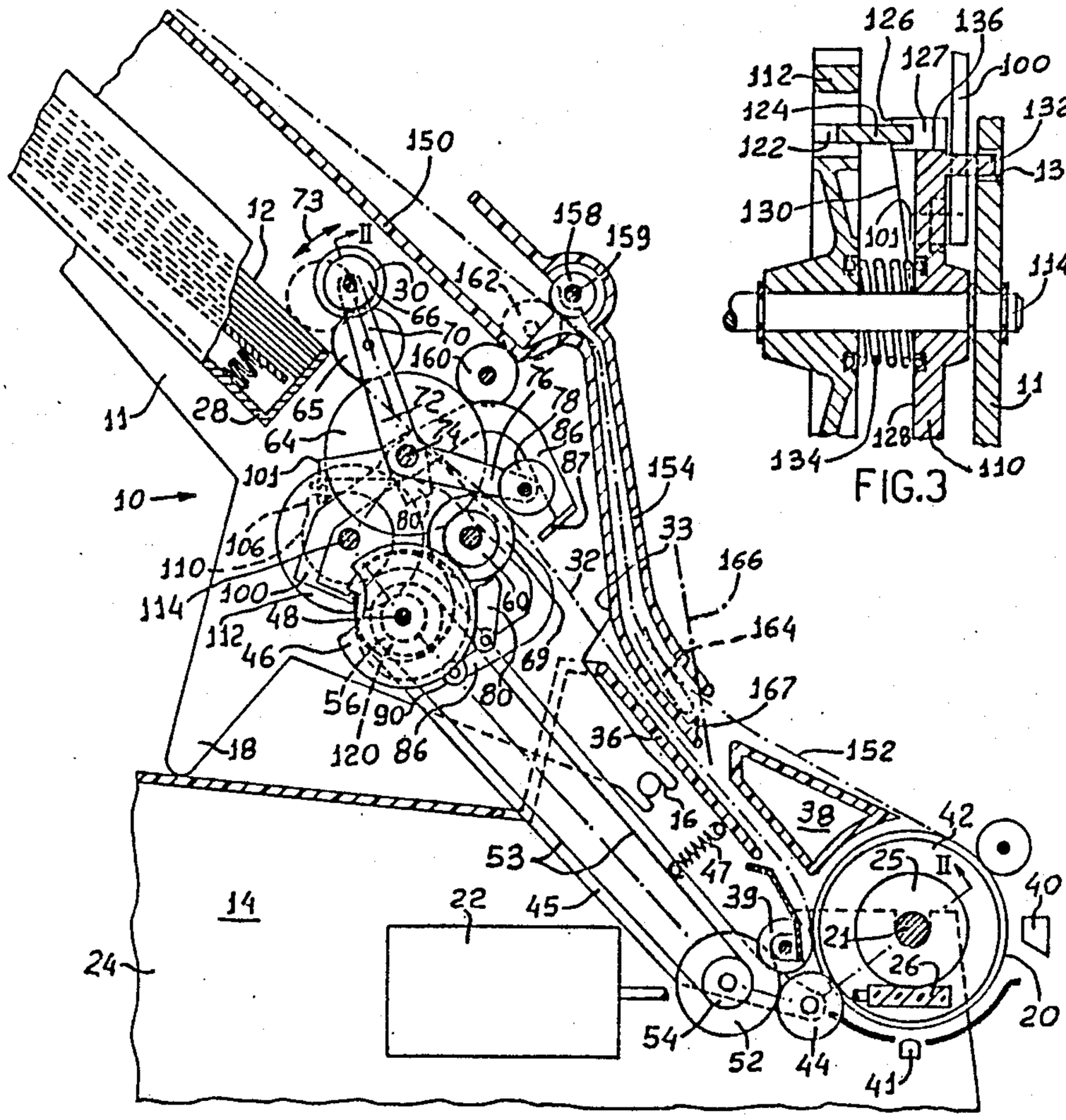
[57] **ABSTRACT**

The sheet feeder can be mounted on a typewriter or on a printer in a system for processing data. The sheets which are accommodated in a feed magazine are passed to the platen roller by friction stripper rollers. After the printing operation, the sheets are passed on to a collection table positioned in front of the feed magazine. The stripper rollers are permanently connected to the platen roller by way of a mechanical transmission and rotate in the same direction as the platen roller. The stripper rollers are mounted on an oscillating arm to be selectively moved towards or away from the first sheet to be fed, by means of a first cam. Before a fresh sheet is fed, a second cam, also coupled to the platen roller, has to be brought to a reference position by rotating the platen roller enough to expel the current sheet. The platen roller is then rotated in the reverse direction, whereby the second cam actuates a lever, thereby to close a clutch. During subsequent rotation of the platen roller in the forward direction, the clutch rotates the first cam through one revolution for engaging the stripper rollers with the top sheet, thereby effecting stripping and feed of a sheet. At the end of the rotary movement through one revolution of the cam, the stripper rollers are moved away from the sheets and the clutch is opened, making the cams inoperative independently of subsequent rotary movements of the platen roller in one direction or the other.

4 Claims, 3 Drawing Sheets

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101
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106
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100
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36
152
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90
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II
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14
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26
20
24
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52
44
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FIG.1

126
136
127
100
112
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132
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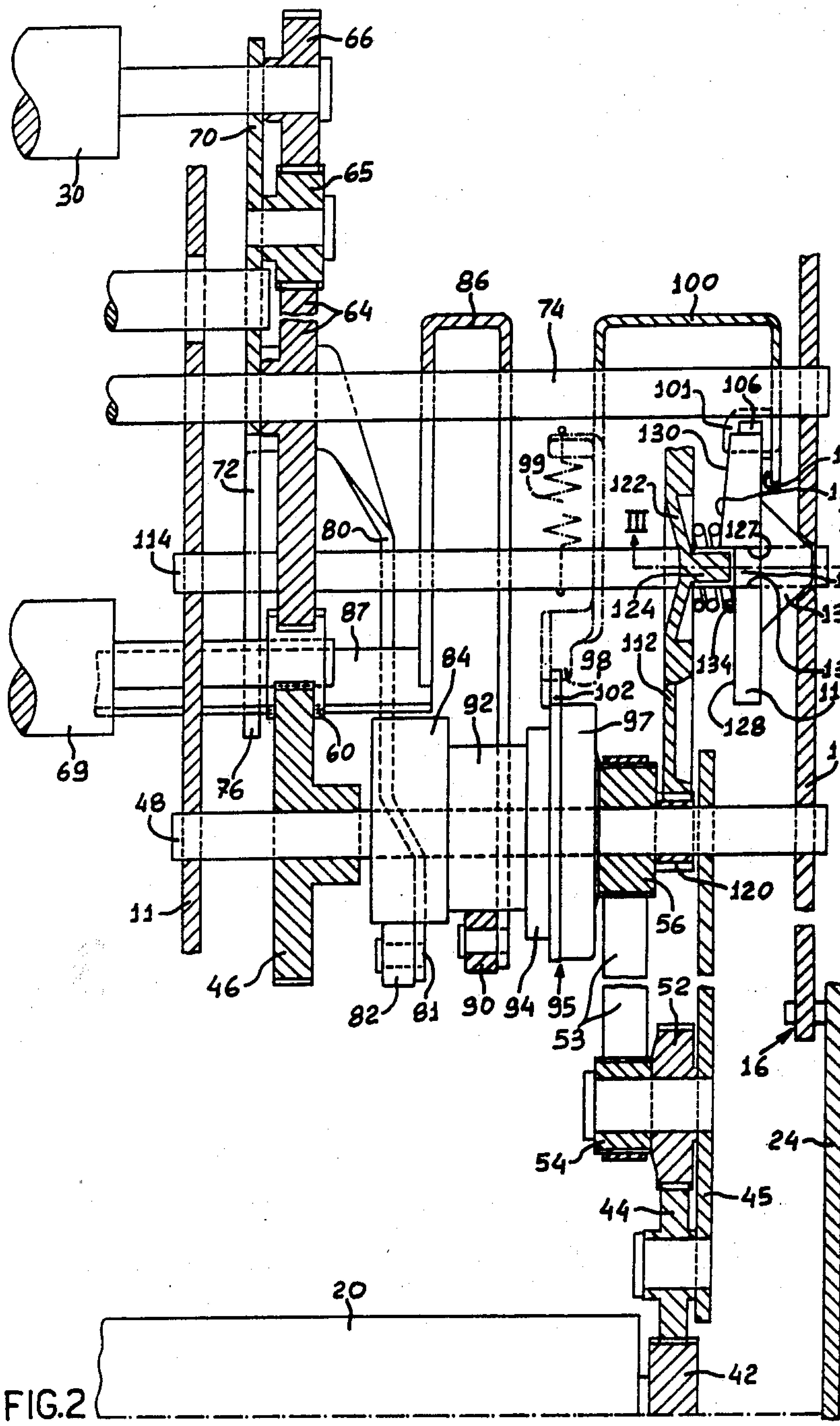
101
114
11
128
134
110

FIG.3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76
11
48
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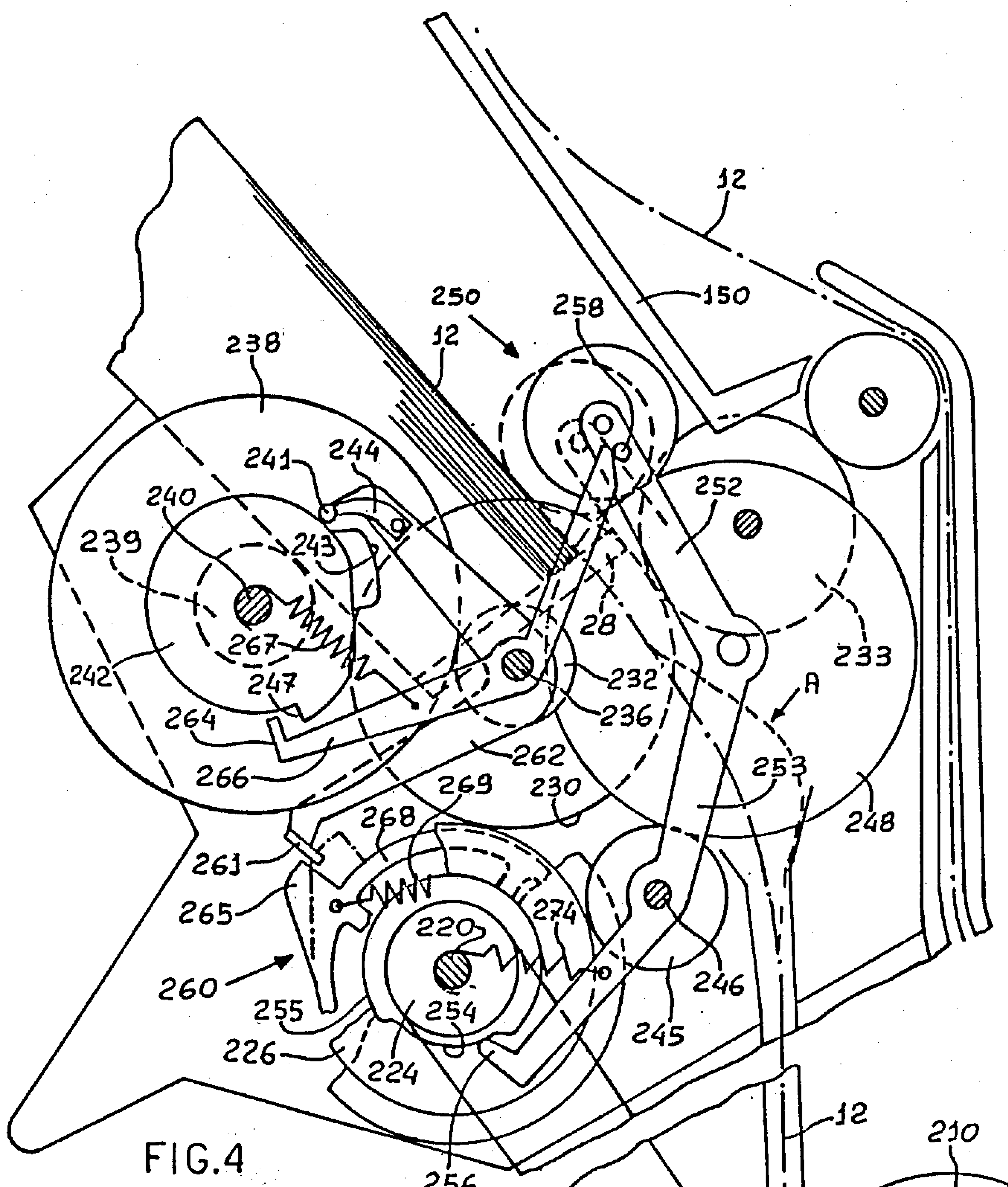
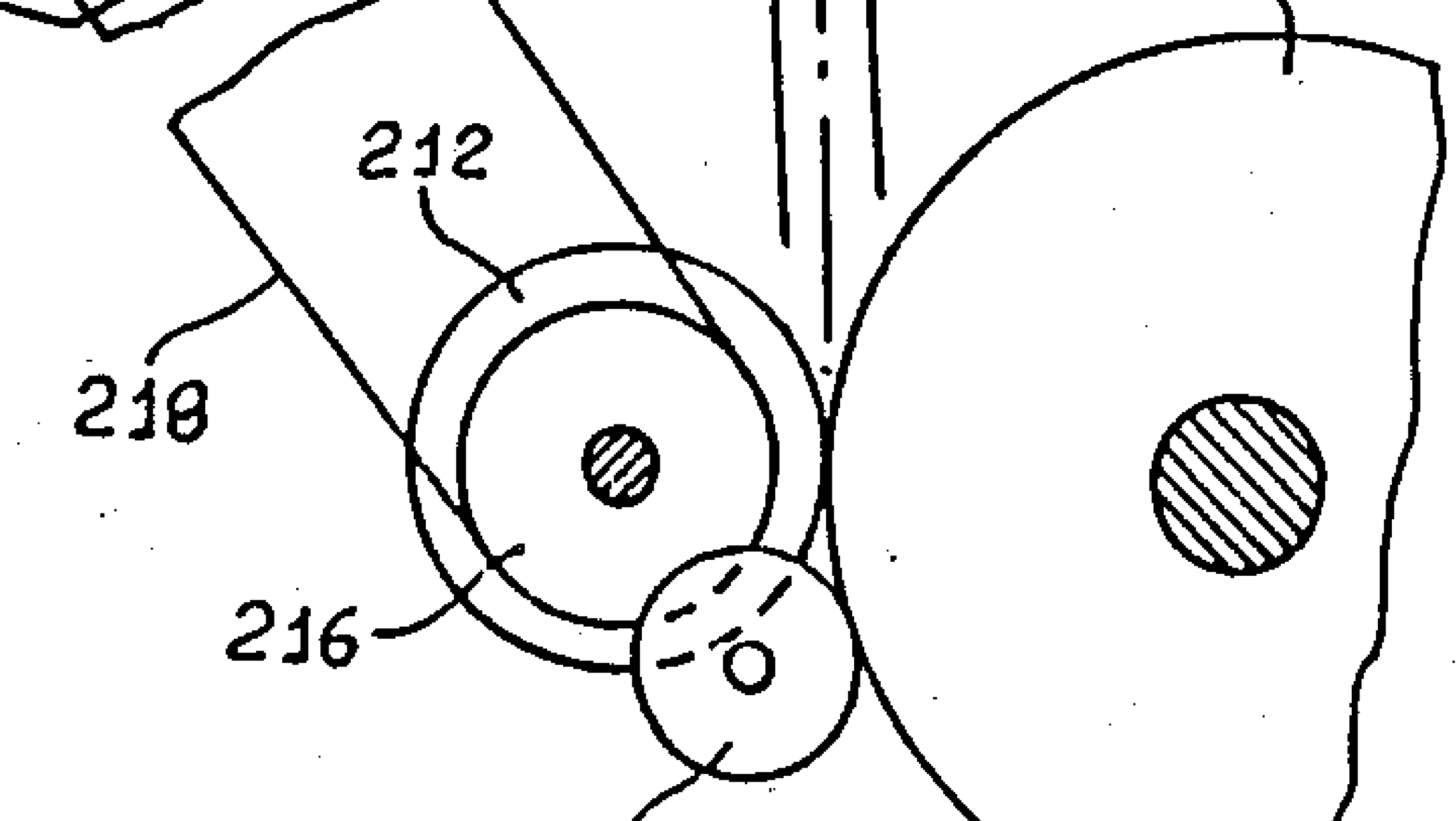
FIG.2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150
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262
253
266
269
230
248
268
261
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224
256
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210
212
218
216
289
41

FIG.4

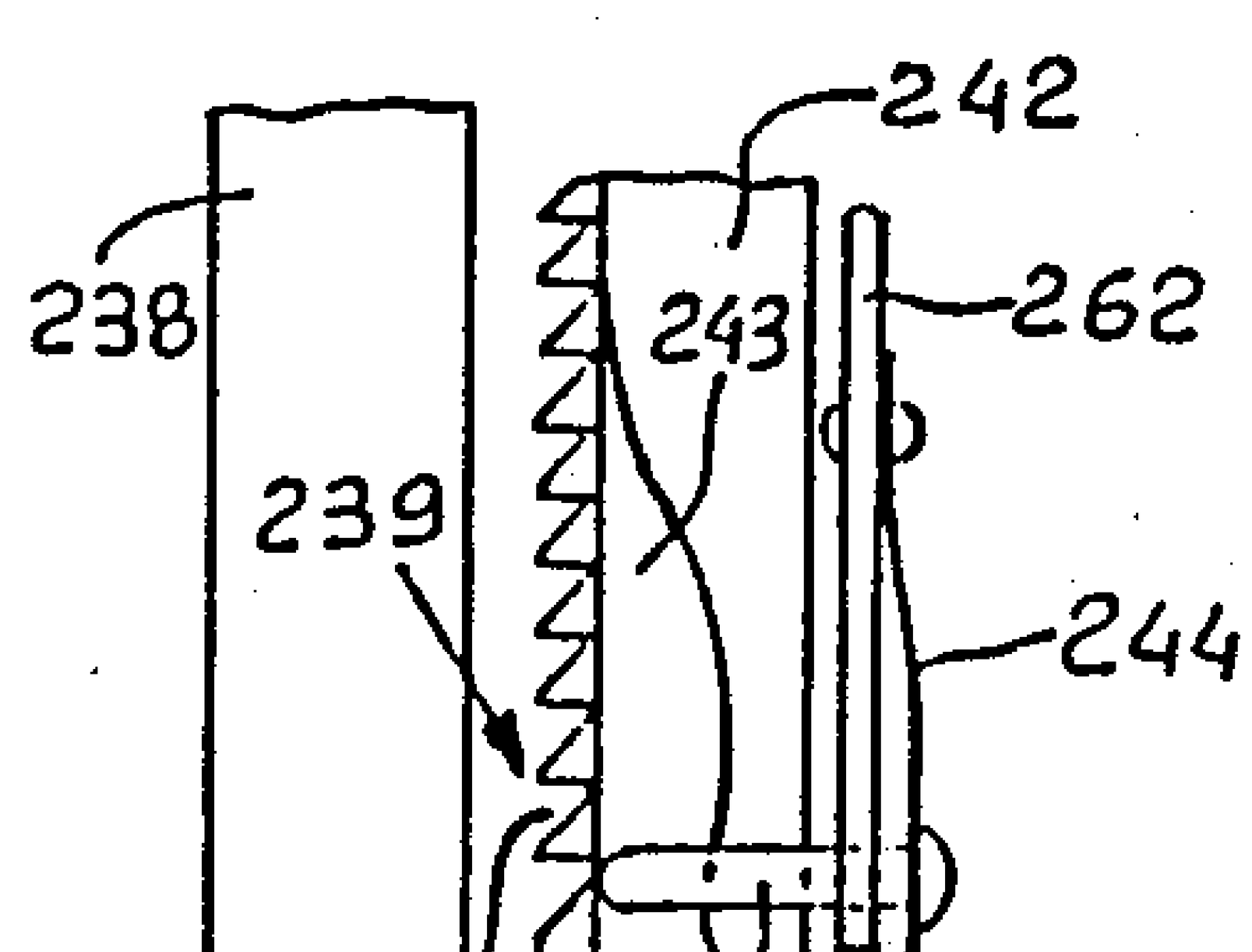
242
262
238
243
239
244
241

FIG.5

AUTOMATIC SHEET FEEDER

BACKGROUND OF THE INVENTION

The present invention relates to an automatic sheet feeder for a typewriter or like office machine, with a platen roller, comprising a feed device with a friction stripper roller, the device being selectively actuable by the platen roller for feeding individual sheets from a pack of sheets disposed in a magazine to the platen roller of the typewriter, the stripper roller being connected to the platen roller by means of a mechanical transmission.

Various types of sheet feeder of the above-indicated kind have been proposed. In one type the mechanical transmission which makes the connection between the platen roller of the typewriter and the stripper roller comprises a free wheel. The free wheel operates in such a way that, when the platen roller rotates in the opposite direction to the feed movement of a sheet, the stripper roller is positively rotated to feed a sheet towards the platen roller while when the platen roller is rotated in the direction of feed movement of the sheet, the stripper roller is not rotated.

This known feeder suffers from the disadvantage that the stripper roller feeds a sheet whenever the platen roller is rotated in the opposite direction to the feed movement, for example to carry out corrections in previously typed or printed lines, thereby giving rise to blockages in the subsequent feed of further sheets.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a sheet feeder which does not suffer from the above-indicated disadvantages, which is of a simple construction and which is easy to use on the part of the operator.

Another object of the invention is to provide a sheet feeder in which the stripper roller is rotated in the direction for feeding a sheet when the platen roller rotates in the forward feed direction, and comprising feed control means responsive to a reverse rotation of the platen roller to cause the stripper roller to move into engagement with the top sheet of the pack, whereby subsequent rotation of the platen roller in the forward feed direction will feed a sheet from the pack.

The invention will be described in more detail, by way of example, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic side view of a sheet feeder embodying the invention,

FIG. **2** is a view of the feeder in section along line II—II in FIG. **1**,

FIG. **3** is a view of detail of the feeder in section taken along line III—III in FIG. **2**,

FIG. **4** is a side view of a second embodiment of the invention, and

FIG. **5** is a fragmentary view of a detail of FIG. **4**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, the feeder **10** for sheets **12** is mounted on a typewriter **14** by means of the latching device **16** and a support leg **18**.

The feeder **10** derives the movement for its own components directly from a platen roller **20** of the typewriter in a manner which will be described hereinafter.

The platen roller **20** is rotated by a motor **22** mounted on the frame structure **24** of the typewriter **14**, by means of a pair of gears **25** and **26**. The motor **22** is controlled by logic circuits of the typewriter, comprising a control unit and a memory which are not illustrated in the drawings.

The fresh sheets of paper **12** are accommodated in a feed magazine **28** which is disposed in the upper part of the feeder, rearwardly with respect to the platen roller **20**.

The sheets **12** are stripped one by one by friction stripper rollers **30** and passed to the platen roller **20** along a path **32** defined by a wall **33** of the feeder **10**, a wall **36** and a wedge-shaped guide **38** which are part of the typewriter **14**. The sheets **12** are fed to the platen roller **20** by means of pressure rollers **39** in a rearward zone of the platen roller **20** with respect to a print member which is diagrammatically indicated at **40** in FIG. **1**.

Fixed on a shaft **21** of the platen roller **20** is a gear **42** with which a toothed gear **44** of the feeder **10** engages when the latter is mounted on the typewriter, in the position shown in FIG. **1**. The movement is transmitted from gear **44** to a gear member **46** which is secured on a rotatable shaft **48** by means of a toothed gear **52**, and a belt **53** which passes around two pulleys **54** and **56** of which the pulley **56** is fixed on the shaft **48** and thus also on the gear member **46**. The gears **44** and **52** are mounted on an arm **45** which is pivoted on the shaft **48** and held by a spring **47** to ensure engagement between the gears **44** and **42**. The gear member **46** in turn transmits the movement to the stripper rollers **30** by way of toothed gears **60**, **64**, **65** and **66**.

The gear **60** is fixed with respect to a row of rollers **69** for advancing the sheets and is disposed downstream of the stripper rollers **30**, along the path of movement **32**.

The gears **65** and **66** are mounted on an arm **70** of a rocker lever **72** which is pivoted on a shaft **74** on which the bear member **64** rotates. Mounted on another arm **76** of the lever **72** are idle rollers **78** which co-operate selectively with the advance rollers **69** to advance a sheet of paper, as will be described hereinafter.

The lever **72** is fixed with respect to a third arm **80** (see FIG. **2**) which at an end **81** carries a cam follower **82** co-operating with a cam **84** which is rotatable on the shaft **48**.

The lever **72** normally remains in a rest position as shown in FIG. **1** in which both the rollers **30** and the rollers **78** are respectively moved away from the sheets **12** and the rollers **69**. The lever **72** can be rotated by the cam **84** in the two directions indicated by an arrow **73**. When it is rotated in the anti-clockwise direction, the lever **72** brings the rollers **30** into contact with the top sheet **12** to separate it from the subjacent sheets and to extract it from the magazine **28**.

When it is rotated in the clockwise direction, the lever **72** moves the rollers **30** away from the sheets **12** and brings the rollers **78** into a position against the rollers **69** in order subsequently to advance the sheet along the path **32**.

Pivotally mounted on the shaft **74** is a lever **86** carrying a registration ruler **87** which is disposed downstream of the rollers **69** and which is used for correctly aligning each sheet before passing it to the platen roller **20**.

The lever **86** is moved by means of a cam follower **90** rolling against a cam **92** mounted on the shaft **48**. The cams **84** and **92** are loosely rotatable on the shaft **48** and are fixed with respect to each other and the driven portion **94** of a clutch **95** whose driving portion **97** is fixed with respect to the pulley **56** and the shaft **48**. The clutch **95** is normally open and is closed selectively by means of an end **98** of a lever or a clutch control member **100** engaged with a tooth **102** of the clutch **95** under the force of a spring **99**. The lever **100** is pivoted on the shaft **74** and has another end **101** engaged with a projection **106** on a disc **110** (see FIGS. **2** and **3**) which is driven in rotation by a gear member **112**. The gear member **112** and the disc **110** are rotatable on a shaft **114**. The member **112** engages with a toothed gear **120** which is fixed with respect to the pulley **56**.

Mounted on the gear member **112** (see FIGS. **2** and **3**), with a resilient connection **122**, is an axially projecting peg **124** engaged with a tooth **126** provided on a face **128** of the disc **110**. The back **129** of the tooth **126** goes down with an inclined surface **130** in the form of a circular ring which is connected to the face **128** of the disc **110**.

The disc **110** is held in a predetermined reference position as shown in FIGS. **2** and **3** by an axial projection **132** which is urged against a seat **133** in the frame structure **11** by an axial spring **134** interposed between the member **112** and the disc **110**. The disc **110** is further provided with a recess **136** disposed in a position corresponding to the tooth **126**. The recess **136** has sides **127** and **131** of different lengths.

When therefore the gear member **112** is rotated for example in the anti-clockwise direction (FIG. **1**), the disc **110** is driven in rotation by the peg **124** which is engaged with the longer side **127** (FIGS. **2** and **3**). Due to the action of the projection **132**, the disc **110** is moved towards the member **112** against the force of the spring **134**. At the same time the peg **124** passes into the recess **136** whereby, when the direction of rotation of the member **112** is reversed, the disc **110** is rotated backwards by the peg **124** engaged with the short side **131**, until the projection **132** passes into the seat **133** again.

In that position the disc **110** is moved away from the member **112** and the peg **124** comes out of the recess **136**, being disengaged from the side **131** of the disc **110**, which remains locked in its reference position.

When therefore the member **112** continues to rotate in the clockwise direction, the peg **124** rises by sliding along the surface **130** until it passes over the tooth **126**, by virtue of the yielding nature of the resilient connection **122** of the peg **124**.

The mode of operation of the feeder according to the present invention is set out below.

In response to a suitable command from the operator, the logic arrangement of the typewriter actuates the stepping motor **22** to rotate the platen roller **20** backwards, that is to say in the opposite direction to the feed movement of a sheet, for example in the clockwise direction in FIG. **1**. The roller **20** is thus caused to rotate backwards by a predetermined number of steps which has been stably stored in the memory, in such a way that the disc **110**, being entrained in the anti-clockwise direction by the peg **124** (see FIGS. **2** and **3**) and after a rotary movement of around 340°, brings the projection **106** under the end **101** of the lever **100**.

The lever **100** thus releases the tooth **102** of the clutch **95** which is closed. At that point the logic arrangement of the typewriter reverses the direction of rotation of the roller **20**.

The shaft **48** and the clutch **95** are then rotated in an anti-clockwise direction, also rotating the cams **84** and **92** while the disc **110** is now rotated in the clockwise direction by the peg **124**.

During that phase, the cam **84** moves the lever **72** in the anti-clockwise direction (FIG. **1**) in such a way as to move the rollers **30** into the broken-line position to commence the feed of the top sheet **12**. At the same time the cam **92** lowers the ruler **87**.

The rollers **30** are kept in contact with the sheet **12** until the front edge thereof bears against the ruler **87**. At that point the cam **92** lifts the ruler **87**, thus releasing the sheet **12**, and the cam **84** rotates the lever **72** in the clockwise direction, moving the rollers **30** away from the sheet **12** and moving the rollers **78** towards the advance rollers **69**. The latter now provide for advance movement of the sheet **12** along the path **32** until the sheet reaches the platen roller under the pressure rollers **39**.

While the leading edge of the sheet is advanced by the platen roller **20** along the line between the pressure rollers **39** and a sensor **41** which is disposed underneath the platen roller **20**, the cam **84** rotates the lever **72** in the anti-clockwise direction, stopping it in the rest position shown in FIG. **1** in which both the rollers **78** and the rollers **30** are moved away from the path **32** of movement of the sheet **12**.

At that point the disc **110** which is entrained by the peg **124** has completed its rotary movement in a clockwise direction through 340°, which was previously covered in the anti-clockwise direction, and is blocked by the projection **132** in the reference position in FIG. **2**. At the same time a tooth **140** disposed on a face of the disc **110** laterally displaces the lever **100** which causes opening of the clutch **95** and consequential stopping of the cams **84** and **92**.

The platen roller **20** continues to rotate in the anti-clockwise direction to bring the sheet **12** into the position for printing thereon in front of the printing member **40**.

The transmission ratio between the platen roller **20** and the gear member **112** is such that a complete revolution of the member **112** and the disc **110** corresponds to the complete feed movement of a sheet of standard length, for example of A4 format, while a rotational movement of the member **112** and the disc **110** through 340° corresponds to the length between the first and last typed or printed lines.

Therefore when the sheet **12** has been advanced by the platen roller **20** and is in the position for printing or typing on the last line thereof, the member **112** has almost completed a revolution in the clockwise direction and the peg **124** has slid along the inclined surface **130** without however passing over the tooth **126**.

It is thus possible to reverse the direction of rotation of the platen roller **20** to move the sheet forwards and backwards any number of times without activating the stripper rollers **30** since the peg **124** of the member **112** moves forwards and backwards along the inclined surface **130** without engaging the tooth **126** and thus the disc **110** remains blocked and the clutch **95** is not closed. It is only when the sheet **12** is advanced beyond the last line of printing or typing to be expelled with a subsequent rotary movement of the roller **20** that the peg **124** passes over the tooth **126** and returns to the initial conditions for a subsequent feed of a second sheet.

At the end of the type operation, the sheet **12** is passed to a collection table **150** (see FIG. **1**) disposed in front of the feed magazine **28**. The sheet is pushed by the roller **20** along the exit path **152** between the wall **33** and a movable guide **154** until the sheet is entrained by the rollers **158** which are rotated by the gear member **64** by way of the gears **160** and **162**. The guide **154** can be rotated in a clockwise direction about the shaft **159** of the rollers **158** from the position shown in FIG. **1** to a position **164** beside the wall **33**. With the guide **154** in the second position **164**, an auxiliary passage **166** is made available, by way of which a sheet can be manually introduced to be wound around the roller **20**, passing into the lower part of the main path **32**. The manually introduced sheet is collected above the guide **154**, on which it is guided by a projection **167** which helps with passing over the thickness of the guide **154**.

In the second embodiment of the sheet feeder shown in FIGS. **4** and **5** it is possible to eliminate the ruler member **87** (FIG. **2**), the associated control members **86**, **90**, **92** and the rollers **69** and **78**.

The platen roller **210** transmits the movement to the pulley **224** by way of the gear member **212**, the pulley **216** and the belt **218**. The pulley **224** is mounted on a shaft **220** fixedly with respect to a gear member **226**. The gear member **226** rotates the toothed sheets **230** and **232** which are fixed with respect to each other and rotatable on a fixed shaft **236**. The wheel **232** meshes with a gear wheel **238** which is rotatable on a shaft **240** and connected by means of a unidirectional clutch **239** to a cam **242** which is coaxial therewith and which has a lobe **243**.

The toothed wheel **230** through the toothed roller **233** engages the roller **235** which is used for expelling a sheet **12** on to a collection shelf **150**.

The gear member **226** further engages with the gear member **245** which is rotatable on a fixed shaft **246** and which is connected to stripper rollers **250** by way of a toothed wheel **248**. The rollers **250** and the rear member **248** are rotatable on an arm **252** of a lever **253** which is pivoted on the shaft **246** and rotated by a cam **254** rotatable on the shaft **220**. The cam **254** is provided with a lobe **255** co-operating with a cam follower portion **256** of the lever **253**. The cam **254** is rotated by the pulley **224** by way of a clutch **260** of known type which is closed selectively by a tooth **261** of a lever **262** pivotally mounted on the shaft **236** and rotated by the lobe **243** of the same **242**.

The mode of operation is as follows:

The roller **210** is first rotated in the direction of forward feed movement of the sheet **12**, for example in the anti-clockwise direction in FIG. **4**, until the gear member **238** has been rotated through 360° in the clockwise direction. In that way the cam **242** is rotated into a reference position in which a shoulder **247** on the cam **242** engages against a tooth **264** of a lever **266** pivotally mounted on the shaft **236** and held in the position shown in FIG. **4** by a spring **267**. The lobe **243** is of such a configuration (see FIG. **5**) that the cam follower **241** passes laterally therebeyond when the cam **242** rotates in the clockwise direction, without rotating the lever **262**. The cam follower **241** is mounted on a resilient tongue portion **244** which is fixed to the lever **262**.

The unidirectional clutch **239** will rotate the cam **242** clockwise until the cam is arrested by the tooth **264**. The clutch will always rotate the cam anti-clockwise when the wheel **238** rotates anti-clockwise.

During the initial rotation of the roller **210**, the clutch **260** is open and the cam **254** remains stationary since the tooth **261** of the lever **262** bears against a raised portion **265** of a member **268** for controlling the clutch **260**.

Subsequently the roller **210** is rotated through a small angle in the opposition direction to the direction of forward feed movement of the sheet **12**, that is to say in the clockwise direction. The lobe **243** of the cam **242** rotates the lever **262** in the clockwise direction, whereby its tooth **261** remains raised beyond the portion **265** of the clutch **260**. The member **268** is therefore displaced by a spring **269** into the position shown in dash-dotted lines, passing under the tooth **261**. In that way the clutch **260** is closed and the cam **254** is connected to the pulley **224**. This action only takes place when the cam **242** is rotated anti-clockwise from the reference position, i.e. after a complete rotation of the gear wheel **238** corresponding to a complete feed movement. Prior to completion of a feed the wheel **238** can rotate the cam **242** back and forth without initiating the feed of a new sheet.

The roller **210** is then again rotated in the direction of forward feed movement of the sheet **12**, that is to way in the anti-clockwise direction, to initiate the cycle of feeding a sheet. The pulley **224** rotates the cam **254** in the clockwise direction. The lever **253** is rotated by the cam **254** in the anti-clockwise direction to bring the stripper rollers **250** against the sheets **12**. The lever **266** is rortated in the anti-clockwise direction by a peg **258** mounted on the arm **252** of the lever **253**, so that the tooth **264** on the lever **266** is moved away from the shoulder **247**, permitting the cam **242** to rotate fixedly with the wheel **238**.

The tooth **261** bears on the outside against the portion **265** and does not impede rotation of the clutch **260** in the clockwise direction fixedly with respect to the pulley **224** and the cam **254**. The sheet **12** is advanced along a path which is shown in dash-dotted lines to the sensor **41** disposed below the platen roller **210**, beyond a pressure roller **289**. The stripper rollers **250** advance the sheet **12** at a speed which is slightly higher than the peripheral speed of the platen roller **210** whereby the sheet forms a loop in the region indicated by the broken lines at A in FIG. **4**. At that point the platen roller **210** is stopped and rotated in the direction opposite to the forward feed movement of the sheet **12** to align the sheet between the roller **289** and the roller **210**. In that operation the rollers **250** rotate in the opposite direction but they do not eliminate totally the previously formed loop A. The sheet **12** is thus also urged by the residual loop between the rollers **289** and **210** which rotate in the direction of pushing the sheet back, so that alignment of the sheet is facilitated. After that the roller **210** is rotated again in the direction of forward feed movement of the sheet until the latter is positioned at the first line of typing in front of the printing member **40** (see FIG. **1**). The wheel **226** and the cam **254** have completed a complete revolution, returning to the position shown in FIG. **4**. The spring **274** rotates the lever **253** in the clockwise direction to move the rollers **250** away from the sheets **12**. The lever **266** is returned to the initial position shown in FIG. **4** by the spring **267**. The toothed **261** engages against the portion **265** to open the clutch **260**. In that way the cam **254** is no longer rotated by the pulley **224** and thus the rollers **250** are no longer in a condition of bearing against the sheets **12**, whereby it is possible for the roller **210** to rotate in one direction or

the other to provide for line spacings forwardly or rearwardly, without feeding further sheets.

The tooth **264** is on the high part of the shoulder **247** of the cam **242** so that a complete clockwise revolution of this cam is again required before an anti-clockwise movement can initite a fresh sheet-feed.

We claim:

1. An automatic sheet feeding unit for a typewriter or like printing office machine having motor means for selectively rotating a platen roller in both a forward direction and a reverse direction with respect to the advancing movement of a sheet toward a printing position, said sheet feeding unit comprising a paper sheet magazine to hold said sheets to be fed to said platen, a separating roller rotatably connected with said platen through a mechanical motion transmission and mounted on a support member selectively rotatable from a rest position to an operating position to bring said separating roller into engagement with a first sheet to be fed to said platen roller, a first cam element cooperating with said support member for rotating the same in said operating position, an operable clutch device interposed between said platen roller and said first cam element for selectively connecting said first cam element with said motion transmission during a forward rotation of the platen roller subsequent to a first reverse platen rotation, a second cam element rotated by said motion transmission for actuating said clutch device when said platen roller rotates in said reverse direction, said second cam element being rotated in such a manner that one complete revolution of said second cam element corresponds to the maximum of the length of a sheet advanced by said platen roller during printing, said second cam element having a lobe and a stopping shoulder, said stopping shoulder stopping said second cam element in an angular reference position corresponding to the starting of said first reverse platen rotation,

a clutch control member cooperating with said lobe and responsive to said first reverse platen rotation to actuate said clutch device, whereby during said subsequent forward platen rotation a sheet is advanced from said magazine towards said platen roller and for disabling said clutch device when said sheet is engaged by said platen roller at the completion of one revolution of said first cam element, and a rotatable lever having a first end cooperating with said support member and a second end, said lever being rotated by said support member in said operating position from a rest position in which said second end engages said shoulder for stopping said second cam element in said reference position, to an active position in which said shoulder overcomes said second end during said forward platen rotation, whereby said first cam element remains stopped, preventing said separating roller from being further engaged with a second sheet in the magazine during both forward and reverse platen rotations occurring after a fed sheet has been engaged by said platen roller.

2. A sheet feeding unit according to claim **1**, wherein said clutch control member is responsive to said reverse platen rotation only when said first reverse platen rotation occurs when said second cam element occupies said reference position, assumed at the completion of a complete feed of a preceding sheet by the platen roller.

3. A sheet feeding unit according to claim **1**, wherein said forward rotation following said first reverse rotation of the platen roller to which the clutch control member is responsive, is a predetermined number of revolutions of the platen roller corresponding to the travel length of a sheet from said magazine to said platen roller and to a rotary movement in a first direction of the second cam of less than one revolution with respect to said respective position.

4. A sheet feeding unit according to claim **3**, wherein said second cam is returned to the reference position during the subsequent rotary movement of the platen roller in the forward direction.

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